

Non-invasive ultrasonic flow and temperature measurement

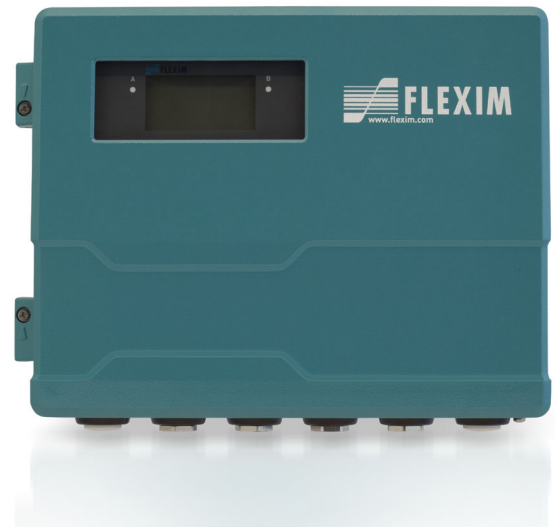
Permanently installed clamp-on measuring system for water and wastewater pipes

Features

- Highly accurate non-invasive flow and temperature measurement irrespective of the flow direction (bidirectional), with outstanding measurement dynamics, excellent zero-point stability and high repeatability of the measurement results
- Submersible ultrasonic transducers (IP68) provide a reliable and durable solution for flow measurement on buried pipes or for applications where the measuring point can be overflowed
- Simple retrofitting on existing water networks without interruption of supply and disposal and without the need for shaft construction and pipe intrusion, thus saving time and cost

Applications

- Flow and temperature measurement on buried water and wastewater pipes
- Flow and temperature measurement on water and wastewater pipes which can be overflowed



FLUXUS WD



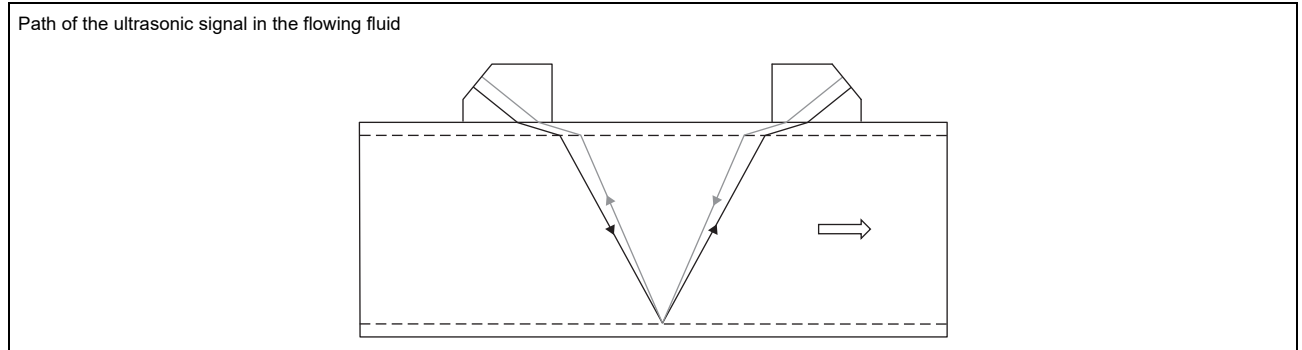
Variofix C

Function	3
Measurement principle	3
Calculation of volumetric flow rate	3
Calculation of sound speed and fluid temperature	4
Number of sound paths	4
Transmitter	5
Technical data	5
Dimensions	7
2" pipe mounting kit	8
Terminal assignment	9
Transducers	10
Transducer selection	10
Technical data	10
Transducer mounting fixture	12
Coupling materials for transducers	12
Connection systems	13
Junction box	15
Technical data	15
Dimensions	16
2" pipe mounting kit	16

Function

Measurement principle

The transducers are mounted on the pipe which is completely filled with the fluid. The ultrasonic signals are emitted alternately by a transducer and received by the other. The physical quantities are determined from the transit times of the ultrasonic signals.

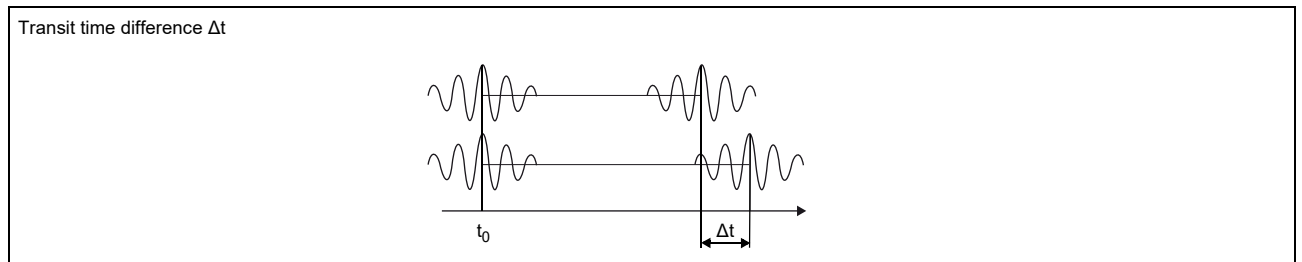


Transit time difference principle

As the fluid where the ultrasound propagates is flowing, the transit time of the ultrasonic signal in flow direction is shorter than the one against the flow direction.

The transit time difference Δt is measured and allows the flowmeter to determine the average flow velocity along the propagation path of the ultrasonic signals. A flow profile correction is then performed in order to obtain the area averaged flow velocity, which is proportional to the volumetric flow rate.

The integrated microprocessors control the entire measuring cycle. The received ultrasonic signals are checked for measurement usability and evaluated for their reliability. Noise signals are eliminated.



HybridTrek

If the gaseous or solid content in the fluid increases occasionally during measurement, a measurement with the transit time difference principle is no longer possible. NoiseTrek mode will then be selected by the flowmeter. This measurement method allows the flowmeter to achieve a stable measurement even with high gaseous or solid content.

The transmitter automatically toggles between the TransitTime and the NoiseTrek mode without having to change the measuring setup.

Calculation of volumetric flow rate

$$\dot{V} = k_{Re} \cdot A \cdot k_a \cdot \frac{\Delta t}{2 \cdot t_y}$$

where

- \dot{V} - volumetric flow rate
- k_{Re} - fluid mechanics calibration factor
- A - cross-sectional pipe area
- k_a - acoustical calibration factor
- Δt - transit time difference
- t_y - average of transit times in the fluid

Calculation of sound speed and fluid temperature

The fluid sound speed can be determined from the transit times in the fluid and the geometry of the measuring point. The sound speed is fluid specific and temperature dependent. This curve is stored in the fluid data set for water. Thus, the fluid temperature can be determined from the sound speed.

Number of sound paths

The number of sound paths is the number of transits of the ultrasonic signal through the fluid in the pipe. Depending on the number of sound paths, the following methods of installation exist:

• **reflection arrangement**

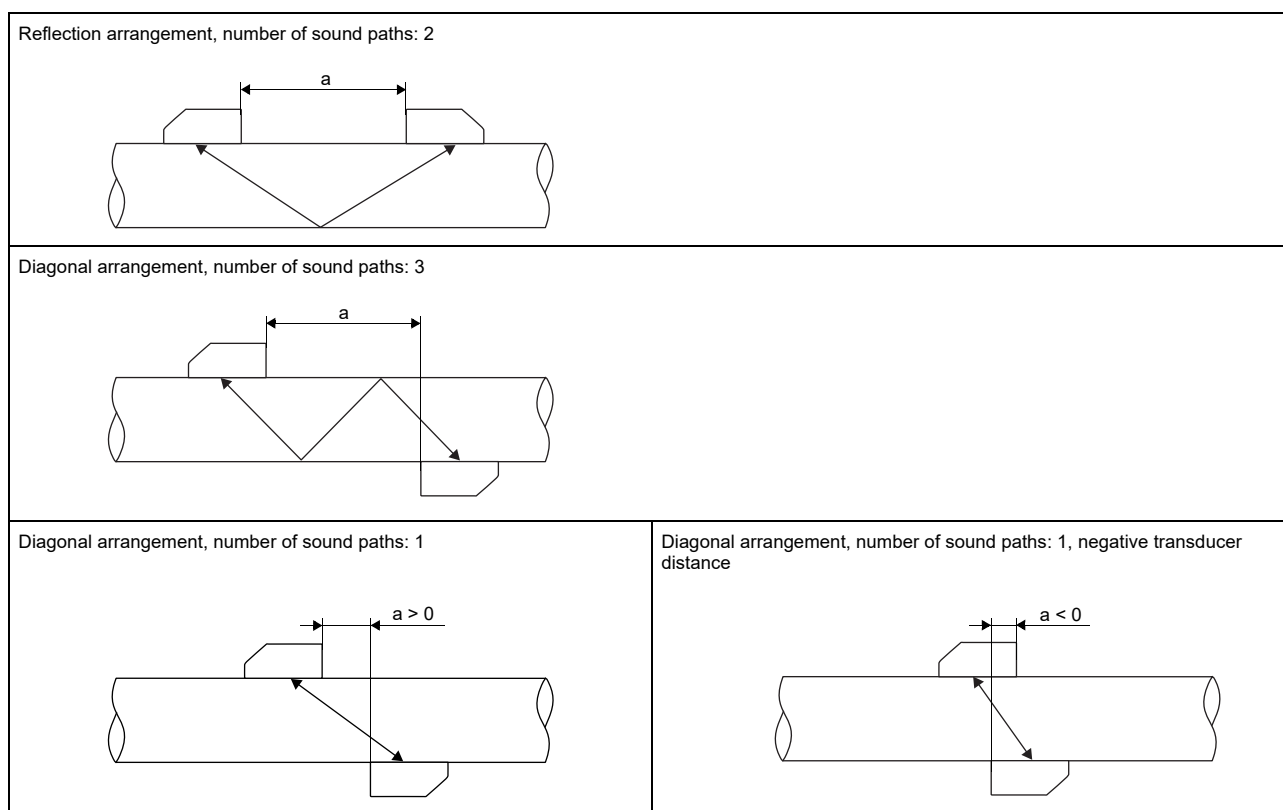
The number of sound paths is even. The transducers are mounted on the same side of the pipe. Correct positioning of the transducers is easy.

• **diagonal arrangement**

The number of sound paths is odd. The transducers are mounted on opposite sides of the pipe. In the case of a high signal attenuation by the fluid, pipe and coatings, diagonal arrangement with 1 sound path will be used.

The preferred method of installation depends on the application. While increasing the number of sound paths increases the accuracy of the measurement, signal attenuation increases as well. The optimum number of sound paths for the parameters of the application will be determined automatically by the transmitter.


As the transducers can be mounted with the transducer mounting fixture in reflection arrangement or diagonal arrangement, the number of sound paths can be adjusted optimally for the application.



a - transducer distance

Transmitter

Technical data

		FLUXUS WD	FLUXUS WD Extended
			
design		standard field device	standard field device with inputs
application		flow measurement on 1 water pipe	flow measurement on 1 or 2 water pipes
transducers		WD6500: CDG1LI8 or CDG1N52 WD1200: CDK1LI8 or CDK1N52 WD400: CDM2LI8 or CDM2N52	
measurement			
measurement principle		transit time difference correlation principle, automatic NoiseTrek selection for measurements with high gaseous or solid content	
flow velocity	m/s	0.01...25	
repeatability		0.15 % MV ±0.005 m/s	
fluid		water	
temperature compensation		corresponding to the recommendations in ANSI/ASME MFC-5.1-2011	
measurement uncertainty (volumetric flow rate)			
measurement uncertainty of the measuring system ¹		±0.3 % MV ±0.005 m/s	
measurement uncertainty at the measuring point ²		±1 % MV ±0.005 m/s	
measurement uncertainty (temperature)			
measurement uncertainty at the measuring point ²		±0.2 K (fluid temperature: 0...30 °C, inner pipe diameter: min. 200 mm)	
transmitter			
power supply		<ul style="list-style-type: none"> • 100...230 V/50...60 Hz or • 20...32 V DC or • 11...16 V DC 	
power consumption	W	< 15	
number of measuring channels		1, optional: 2	2
damping	s	0...100 (adjustable)	
measuring cycle	Hz	100...1000 (1 channel)	
response time	s	1 (1 channel), option: 0.02	
housing material		aluminum, powder coated or stainless steel 316L (1.4404)	
degree of protection		IP66	
dimensions	mm	see dimensional drawing	
weight	kg	aluminum housing: 5.4 stainless steel housing: 5.1	
fixation		wall mounting, optional: 2" pipe mounting	
ambient temperature	°C	-40...+60 (< -20 without operation of the display)	
display		128 x 64 pixels, backlight	
menu language		English, German, French, Spanish, Dutch, Russian, Polish, Turkish, Italian	
measuring functions			
physical quantities		volumetric flow rate, mass flow rate, flow velocity	
totaliser		volume, mass	
calculation functions		average, difference, sum (2 measuring channels necessary)	
diagnostic functions		sound speed, fluid temperature, signal amplitude, SNR, SCNR, standard deviation of amplitudes and transit times	
communication interfaces			
service interfaces		measured value transmission, parametrisation of the transmitter: <ul style="list-style-type: none"> • USB • LAN 	
process interfaces		max. 1 option: <ul style="list-style-type: none"> • RS485 (ASCII sender) • Modbus RTU • BACnet MS/TP • M-Bus • HART • Profibus PA • FF H1 • Modbus TCP • BACnet IP 	

¹ with aperture calibration of the transducers

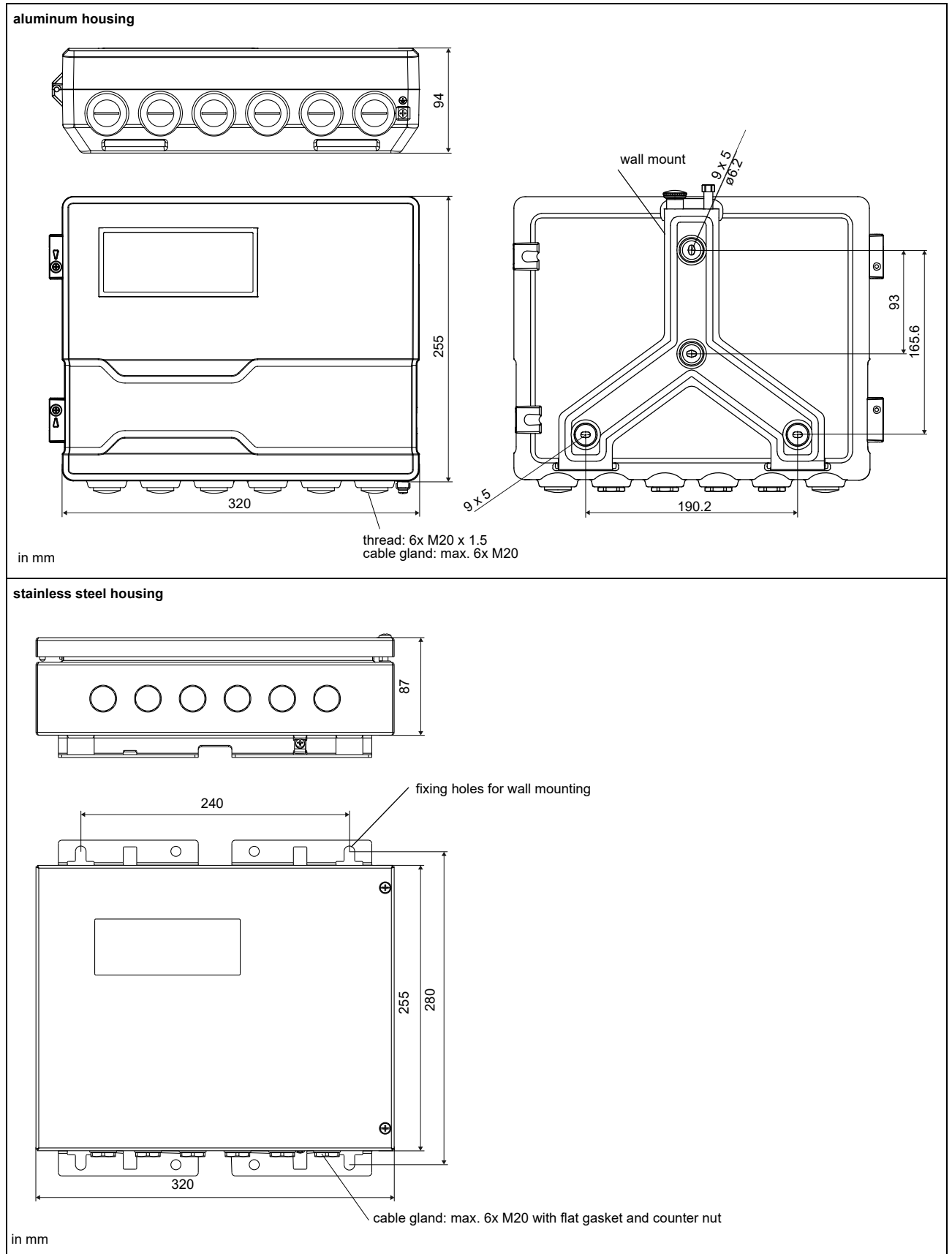
² for transit time difference principle and reference conditions

		FLUXUS WD	FLUXUS WD Extended
accessories			
data transmission kit		USB cable	
software		<ul style="list-style-type: none"> FluxDiagReader: reading of measured values and parameters, graphical presentation FluxDiag (optional): reading of measurement data, graphical presentation, report generation, parametrisation of the transmitter 	
data logger			
loggable values		all physical quantities, totalised physical quantities and diagnostic values	
capacity		max. 800 000 measured values	
outputs			
The outputs are galvanically isolated from the transmitter.			
number		<ul style="list-style-type: none"> switchable current output: 2 or (1 and HART) digital output: 2 	<ul style="list-style-type: none"> switchable current output: 4 or (2 and HART) digital output: 3
• switchable current output			
range	mA	4...20 (3.2...22)	
accuracy		0.04 % MV ±3 µA	
active output		R _{ext} < 350 Ω	
passive output		U _{ext} = 8...30 V, depending on R _{ext} (R _{ext} < 1 kΩ at 30 V)	
• HART			
range	mA	4...20	
accuracy		0.1 % MV ±15 µA	
active output		U _{int} = 24 V, R _{ext} < 500 Ω	
• digital output			
functions		<ul style="list-style-type: none"> frequency output binary output pulse output 	
number		3	
operating parameters		5...30 V / < 100 mA	
frequency output			
• range	kHz	0...5	
binary output			
• binary output as alarm output		limit, change of flow direction or error	
pulse output			
• functions		mainly for totalising	
• pulse value	units	0.01...1000	
• pulse width	ms	0.05...1000	
inputs			
The inputs are galvanically isolated from the transmitter.			
• current input			
number		2	
accuracy		0.1 % MV ±10 µA	
active input		U _{int} = 24 V, R _{int} = 50 Ω, P _{int} < 0.5 W, not short-circuit proof	
• range	mA	0...20	
passive input		R _{int} = 50 Ω, P _{int} < 0.3 W	
• range	mA	-20...+20	

¹ with aperture calibration of the transducers

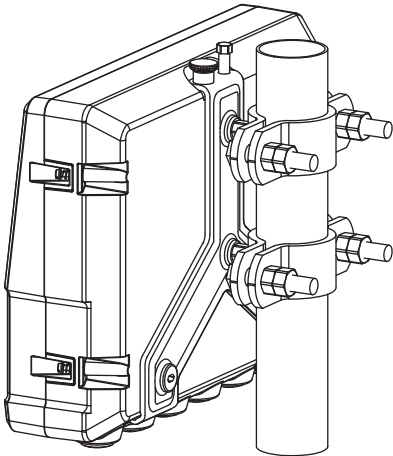
² for transit time difference principle and reference conditions

Dimensions



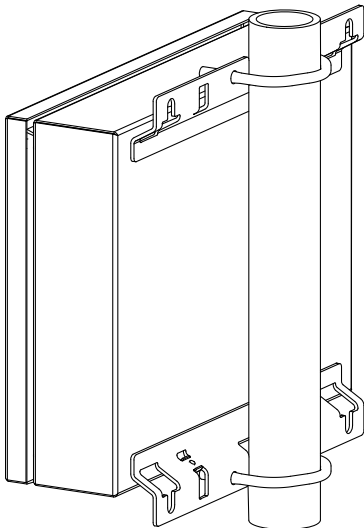
2" pipe mounting kit

aluminum housing



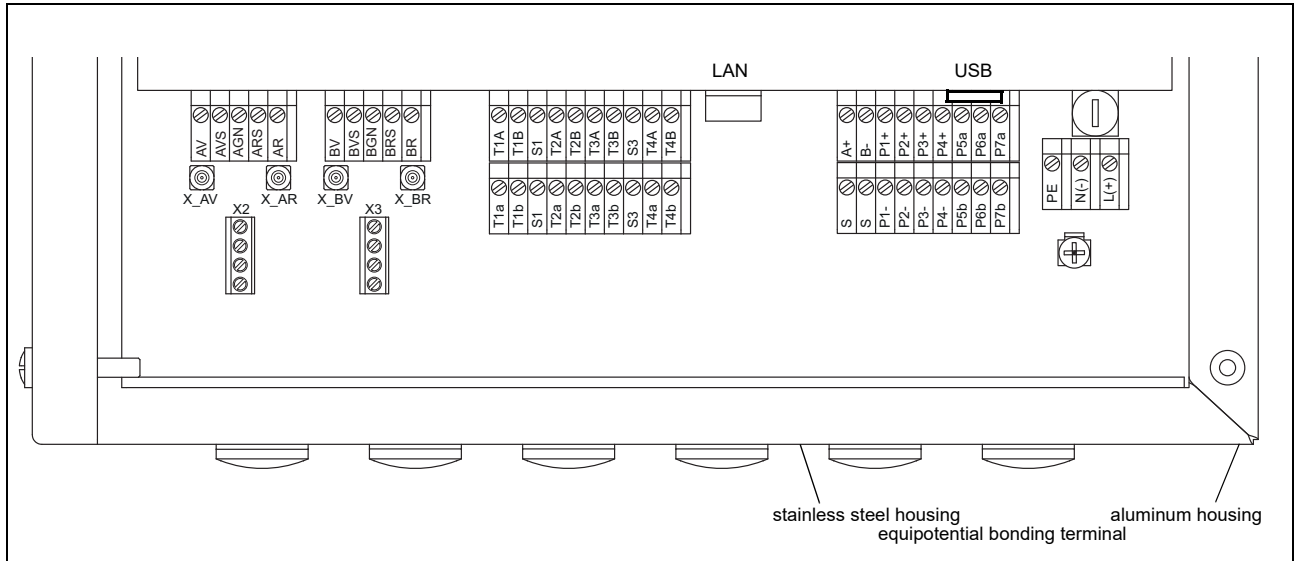
order code:
ACC-PE-*721-/PMK4

stainless steel housing



order code:
ACC-PE-*721-/PMK6

Terminal assignment

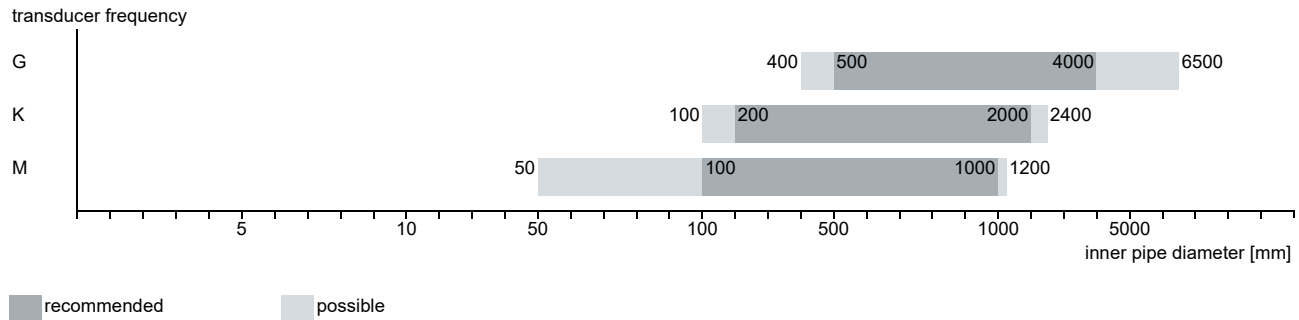


power supply ¹				
terminal	connection (AC)		connection (DC)	
PE	earth		earth	
N(-)	neutral		-	
L(+)	phase		+	
transducers, extension cable				
measuring channel A		measuring channel B		transducer
terminal	connection	terminal	connection	
AV	signal	BV	signal	↑
AVS	internal shield	BVS	internal shield	↕
ARS	internal shield	BRS	internal shield	
AR	signal	BR	signal	
outputs ¹				
terminal	connection	terminal	connection	communication interface
P1+...P4+ P1-...P4-	current output, HART (P1)	A+	signal +	<ul style="list-style-type: none"> • RS485¹ • Modbus RTU¹ • BACnet MS/TP¹ • M-Bus¹ • Profibus PA¹ • FF H1¹
			B-	
P5a...P7a P5b...P7b	digital output	S	shield	
			USB	type B Hi-Speed USB 2.0 Device
		LAN	RJ45 10/100 Mbps Ethernet	<ul style="list-style-type: none"> • service (FluxDiag/FluxDiagReader) • Modbus TCP • BACnet IP

¹ cable (by customer):
 - e.g. flexible wires, with insulated wire ferrules, wire cross-section: 0.25...2.5 mm²
 - outer diameter of the cable (stainless steel housing, with ferrite nut): max. 7.6 mm

Transducers

Transducer selection

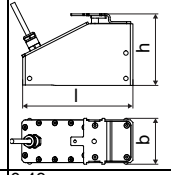
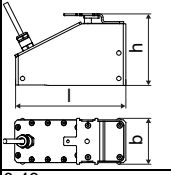
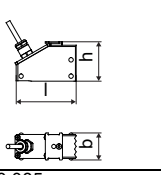


Technical data

Shear wave transducers

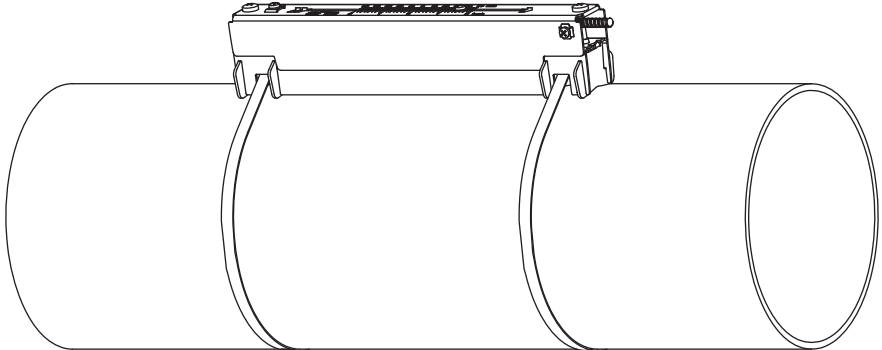
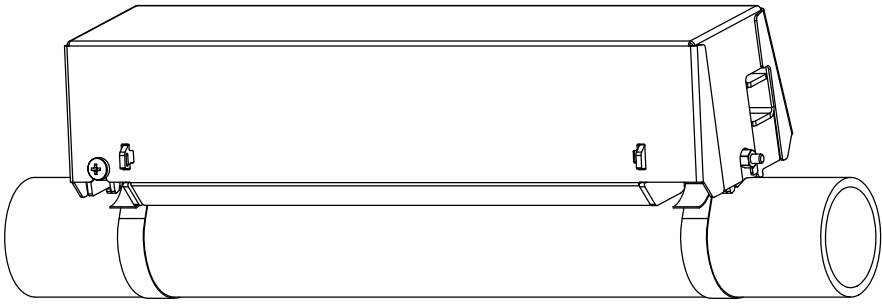
technical type		CDG1N52	CDK1N52	CDM2N52
transducer frequency /MHz		0.2	0.5	1
inner pipe diameter d				
min. extended	mm	400	100	50
min. recommended	mm	500	200	100
max. recommended	mm	4000	2000	1000
max. extended	mm	6500	2400	1200
pipe wall thickness				
min.	mm	11	5	2.5
material				
housing		PEEK with stainless steel cover 316L (1.4404)	PEEK with stainless steel cover 316L (1.4404)	PEEK with stainless steel cover 316L (1.4404)
contact surface		PEEK	PEEK	PEEK
degree of protection		IP67	IP67	IP67
transducer cable				
type		1699	1699	1699
length	m	5	5	4
dimensions				
length l	mm	129.5	126.5	64
width b	mm	51	51	32
height h	mm	67	67.5	40.5
dimensional drawing				
weight (without cable)	kg	0.47	0.36	0.066
pipe surface temperature				
min.	°C	-40	-40	-40
max.	°C	+130	+130	+130
ambient temperature				
min.	°C	-40	-40	-40
max.	°C	+130	+130	+130
temperature compensation		x	x	x

Shear wave transducers (IP68)

technical type		CDG1LI8	CDK1LI8	CDM2LI8
transducer frequency	MHz	0.2	0.5	1
inner pipe diameter d				
min. extended	mm	400	100	50
min. recommended	mm	500	200	100
max. recommended	mm	4000	2000	1000
max. extended	mm	6500	2400	1200
pipe wall thickness				
min.	mm	11	5	2.5
material				
housing		PEEK with stainless steel cover 316Ti (1.4571)	PEEK with stainless steel cover 316Ti (1.4571)	PEEK with stainless steel cover 316Ti (1.4571)
contact surface		PEEK	PEEK	PEEK
degree of protection		IP68 ¹	IP68 ¹	IP68 ¹
transducer cable				
type		2550	2550	2550
length	m	12	12	12
dimensions				
length l	mm	130	130	72
width b	mm	54	54	32
height h	mm	83.5	83.5	46
dimensional drawing				
weight (without cable)	kg	0.43	0.43	0.085
pipe surface temperature				
min.	°C	-40	-40	-40
max.	°C	+100	+100	+100
ambient temperature				
min.	°C	-40	-40	-40
max.	°C	+100	+100	+100
temperature compensation		x	x	x

¹ test conditions: 3 months/2 bar (20 m)/20 °C

Transducer mounting fixture

<p>Variofix L (VLK, VLM)</p> 	<p>material: 316Ti (1.4571), 316L (1.4404), 17-7PH (1.4568) inner length: VLK: 348 mm, option IP68: 368 mm VLM: 234 mm dimensions: VLK: 423 x 90 x 93 mm option IP68: 443 x 94 x 105 mm VLM: 309 x 57 x 63 mm</p>
<p>Variofix C (VCK, VCM)</p> 	<p>material: stainless steel 316Ti (1.4571) inner length: VCK-*S: 350 mm VCM: 400 mm dimensions: VCK-*S: 410 x 126 x 125 mm VCM: 460 x 96 x 82 mm</p>

Coupling materials for transducers

type	ambient temperature °C
coupling foil type VT	-10...+200

Connection systems

connection system TS		
connection with extension cable	direct connection	transducers technical type
<p>JB03</p>		****52
connection system T1		
<p>JBP3</p>		****L1*

Cable

transducer cable			
type		1699	2550
weight	kg/m	0.094	0.035
ambient temperature	°C	-55...+200	-40...+100
properties			longitudinal watertight
cable jacket			
material		PTFE	PUR
outer diameter	mm	2.9	5.2 ±0.2
thickness	mm	0.3	0.9
colour		brown	grey
shield	x		x
sheath			
material		stainless steel 316Ti (1.4571)	-
outer diameter	mm	8	-

extension cable			
type		2615	5245
order code		ACC-PE- GNNN-/EXEXXXX	ACC-PE- GNNN-/EXA1XXX
weight	kg/m	0.18	0.38
ambient temperature	°C	-30...+70	-30...+70
properties		halogen free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2	halogen free fire propagation test according to IEC 60332-1 combustion test according to IEC 60754-2
cable jacket			
material		PUR	PUR
outer diameter	mm	max. 12	max. 12
thickness	mm	2	2
colour		black	black
shield	x		x
sheath			
material		-	steel wire braid with copolymer sheath
outer diameter	mm	-	max. 15.5

XXX - cable length in m

Cable length

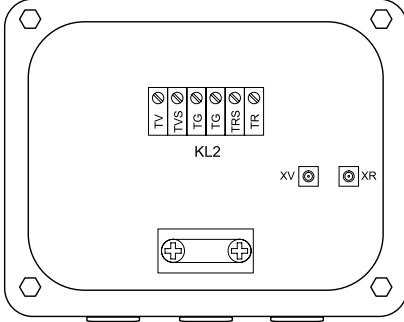
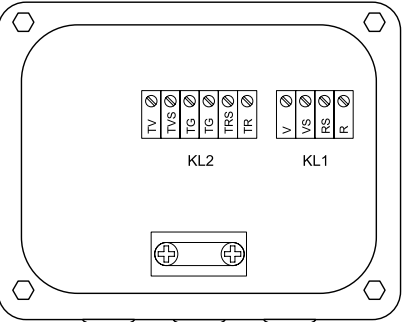
transducer frequency		F, G, H, K		M, P		Q		S	
connection system TS									
transducers technical type		x	l	x	l	x	l	x	l
*D***5*	m	5	≤ 300	4	≤ 300	3	≤ 90	2	≤ 40
****LJ*	m	12	≤ 300	12	≤ 300	-	-	-	-

x - transducer cable length

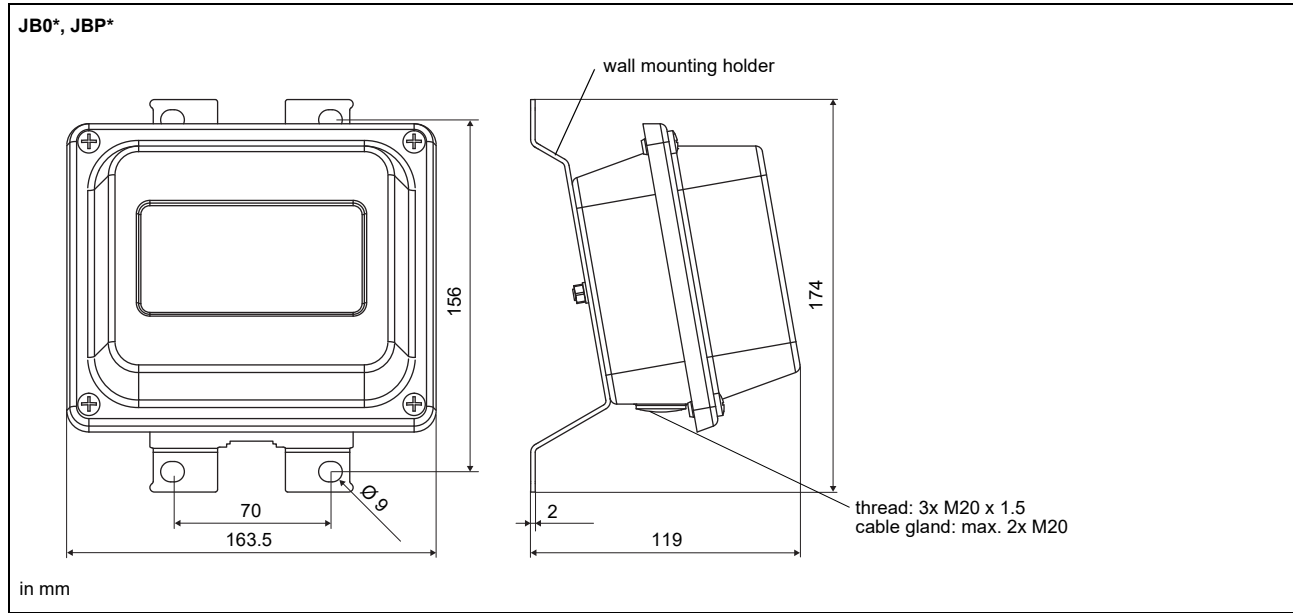
l - max. length of extension cable (depending on the application)

Junction box

Technical data

JB03																															
order code		ACC-PE-GNNN-JBS11																													
weight	kg	1.2 kg																													
fixation		wall mounting optional: 2" pipe mounting																													
material																															
housing		stainless steel 316L (1.4404)																													
gasket		silicone																													
degree of protection		IP67																													
ambient temperature																															
min.	°C	-40																													
max.	°C	+80																													
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Connection</p>  </div> <div style="width: 45%;"> <p>Transducers</p> <table border="1"> <thead> <tr> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td>XV</td> <td>SMB connector</td> <td>↑</td> </tr> <tr> <td>XR</td> <td>SMB connector</td> <td>⤴</td> </tr> </tbody> </table> <p>Extension cable</p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL2</td> <td>TV</td> <td>signal</td> </tr> <tr> <td>TVS</td> <td>internal shield</td> </tr> <tr> <td>TRS</td> <td>internal shield</td> </tr> <tr> <td>TR</td> <td>signal</td> </tr> </tbody> </table> </div> </div>			terminal	connection	transducer	XV	SMB connector	↑	XR	SMB connector	⤴	terminal strip	terminal	connection	KL2	TV	signal	TVS	internal shield	TRS	internal shield	TR	signal								
terminal	connection	transducer																													
XV	SMB connector	↑																													
XR	SMB connector	⤴																													
terminal strip	terminal	connection																													
KL2	TV	signal																													
	TVS	internal shield																													
	TRS	internal shield																													
	TR	signal																													
JBP3																															
weight	kg	1.2 kg																													
fixation		wall mounting optional: 2" pipe mounting																													
material																															
housing		stainless steel 316L (1.4404)																													
gasket		silicone																													
degree of protection		IP67																													
ambient temperature																															
min.	°C	-40																													
max.	°C	+80																													
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Connection</p>  </div> <div style="width: 45%;"> <p>Transducers</p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> <th>transducer</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL1</td> <td>V</td> <td>signal</td> <td>↑</td> </tr> <tr> <td>VS</td> <td>internal shield</td> <td></td> </tr> <tr> <td>RS</td> <td>internal shield</td> <td>⤴</td> </tr> <tr> <td>R</td> <td>signal</td> <td></td> </tr> </tbody> </table> <p>Extension cable</p> <table border="1"> <thead> <tr> <th>terminal strip</th> <th>terminal</th> <th>connection</th> </tr> </thead> <tbody> <tr> <td rowspan="4">KL2</td> <td>TV</td> <td>signal</td> </tr> <tr> <td>TVS</td> <td>internal shield</td> </tr> <tr> <td>TRS</td> <td>internal shield</td> </tr> <tr> <td>TR</td> <td>signal</td> </tr> </tbody> </table> </div> </div>			terminal strip	terminal	connection	transducer	KL1	V	signal	↑	VS	internal shield		RS	internal shield	⤴	R	signal		terminal strip	terminal	connection	KL2	TV	signal	TVS	internal shield	TRS	internal shield	TR	signal
terminal strip	terminal	connection	transducer																												
KL1	V	signal	↑																												
	VS	internal shield																													
	RS	internal shield	⤴																												
	R	signal																													
terminal strip	terminal	connection																													
KL2	TV	signal																													
	TVS	internal shield																													
	TRS	internal shield																													
	TR	signal																													

Dimensions



2" pipe mounting kit



FLEXIM GmbH
Boxberger Str. 4
12681 Berlin
Germany
Tel.: +49 (30) 93 66 76 60
Fax: +49 (30) 93 66 76 80
internet: www.flexim.com
e-mail: info@flexim.com

Subject to change without prior notice.
Errors excepted.

FLUXUS is a registered trademark of FLEXIM GmbH.

Copyright (©) FLEXIM GmbH 2021